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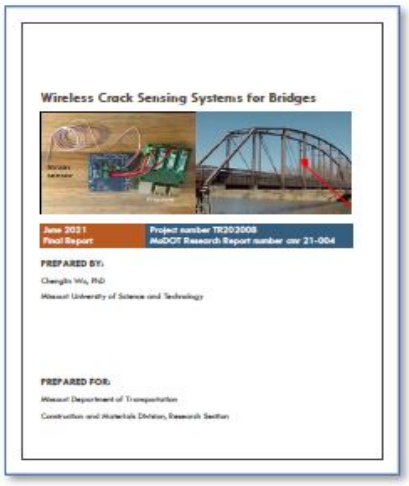
Research Summary

Wireless Crack Sensing Systems for Bridges



The main objective of this research was to develop and deploy a wireless crack sensing system that can measure and monitor cracks for both concrete and steel bridge structures. This system contains the sensing unit, wireless data transmitting system, as well as a data processing unit.

The sensing unit consists of single or arrays of advanced thin film-based sensing nodes that are capable of measuring crack induced strains in bridge structures. This thin film sensing node contains soft polymer film (polyvinylidene difluoride, PVDF) embedded with conductive nanoparticles (graphene) or atomically thin films. Both the Poisson's effect and contact mechanism were considered to covert the strain to electrical resistance of the sensing unit.

This sensing unit is also connected to a wireless transmitting system to broadcast the signal wirelessly. The wireless transmitting system utilizes a blue-tooth technology that can enable the sensing unit to broadcast electronic signals in terms of electrical resistance. These signals were received by a mobile device (laptop or cellphone) that can convert the electrical resistance information into the measured stains.

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These measurements are processed using the data processing unit. The data processing unit receives the electrical resistance data and converts it into measured strains. The machine learning approach was also taken to train the software to be able to automatically detect the abnormalities in the measured strain for critical crack growth detection.

Figure 1: Experiment set up for strain sensor calibration.

Project Information

PROJECT NAME: TR202008—Wireless Crack Sensing

PROJECT START/END DATE: July 2019-June 2021

PROJECT COST: $50,000

LEAD CONTRACTOR: Missouri University of Science & Technology

PRINCIPAL INVESTIGATOR: Chenglin Wu, Ph.D.

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Project Manager

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